PB88-185756

Superfund Record of Decision (EPA Region 2) Katonah Municipal Well, Bedford, New York (First Remedial Action), September 1987

(U.S.) Environmental Protection Agency
Washington, DC

25 Sep 87

U.S. Department of Commerce
National Technical Information Service

United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R02-87/047
September 1987

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EPA

Superfund Record of Decision:

Katonah Municipal Well, NY

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16. ABSTRACT

The Katonah Municipal Well site is located in the Village of Katonah in the Town of Bedford, Westchester County, New York. The well is situated on a peninsula owned by the City of New York that extends into the Muscoot Reservoir. In 1978 the Westchester County Department of Health (WCDH), acting on Putnam County Health Department findings, sampled the Katonah well and other local wells for contamination. These samples revealed the presence of tetrachloroethylene (PCE) and other VOCs in the well water. These contaminants were traced to a local septic waste collector who was disposing of wastes taken from several Katonah dry cleaning establishments. In 1978 the Katonah well was closed and source control measures were initiated requiring dry cleaning establishments to pump out their septic systems and modify solvent disposal techniques. Initial attempts by WCDH and the Town of Bedford to remove contamination from the affected aquifer failed. The primary contaminant of concern affecting the ground water is PCE.

The selected remedial action for this site includes: installation of a new production well adjacent to the abandoned well; filling and sealing of the abandoned Katonah well; installation and operation of an onsite air stripping facility to remove PCE and other volatiles from the aquifer with discharge of treated water to the Bedford Consolidated Water District distributor system; establishment of a monitoring program to

(See Attached Sheet)

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Record of Decision Katonah Municipal Well, NY First Remedial Action - Final Contaminated Media: gw Key contaminants: PCE, TCE		

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16. ABSTRACT (continued)

detect residual contamination of treated water; and recommendations to the Town of Bedford to remove trash and debris located on the peninsula. The estimated capital cost for this remedial action is $1,365,000 with annual O&M of $296,000.

ATTENTION

AS NOTED IN THE NTIS ANNOUNCEMENT, PORTIONS OF THIS REPORT ARE NOT LEGIBLE. HOWEVER, IT IS THE BEST REPRODUCTION AVAILABLE FROM THE COPY SENT TO NTIS.

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233-

Thomas C. [illegible]
Commissioner

AUG 12 1987

Mr. Stephen Luftig
Acting Director
Office of Emergency and Remedial Response
U. S. Environmental Protection Agency
Region II
26 Federal Plaza
New York, NY 10278

Dear Mr. Luftig:

Re: Katonah Municipal Well Superfund
Site Remedial Action

The New York State Department of Environmental Conservation has reviewed the information presented in the Remedial Investigation (RI) Report for the Katonah Municipal Well Site and concurs with United States Environmental Protection Agency's selection (prior to the public comment period) of the installation of a new production well, the installation of an air stripper to remove volatile organic compounds, and initiation of a long-term monitoring program as the preferred remediation alternative.

The basis for our concurrence for installation of a new production well is that the existing well has lost much of its original capacity and would have to be renovated to restore that capacity. Because doing so would cost about the same as a new well and because restoration of the original capacity cannot be assured, we agree that a new well is preferable. Also, we agree that installation and operation of an air stripper are desirable because the risk analysis projects a potential cancer risk of 2×10^{-5} in untreated well water under pumping conditions (i.e., not static conditions) which is due primarily to tetrachloroethylene (PCE). The stripping of PCE by a packed column, as proposed in the preferred remediation alternative, would virtually eliminate PCE (and any trichloroethylene in the raw water) from the water sent to the distribution system and decrease the cancer risk to about 1×10^{-7}. A long-term monitoring plan would complement this program by assuring that this remediation measure provides acceptable water to the distribution system.

Although we concur with the preferred alternative at this time, we are interested in public comments that are made on this alternative as well as on other alternatives that were evaluated during the study. A

final remediation selection should only be made after carefully considering all such comments.

If you have questions, please call either me at (518) 457-6603 or Bill Eberle, of my staff, at (518) 457-1708.

Sincerely,

Norman H. Nosenchuck, P.E.
Director
Division of Solid and Hazardous Waste

KATONAH MUNICIPAL WELL SITE
BEDFORD, NEW YORK
FINAL RESPONSIVENESS SUMMARY

The U.S. Environmental Protection Agency (EPA) released the draft Remedial Investigation and Feasibility Study (RI/FS) and Proposed Remedial Action Plan (PRAP) for the Katonah Municipal Well site on July 22, 1987. Copies were placed on file at the Katonah Village Library, Katonah, New York and the Bedford Hills Free Library, Bedford Hills, New York for a three week public comment period from July 27, 1987 to August 20, 1987.

EPA also held a public meeting on August 5, 1987 at the Bedford Town Hall, Bedford, New York to describe the proposed remedial alternatives and present EPA's preferred remedial alternative for the Katonah Municipal Well site.

A responsiveness summary is required by Superfund policy for the purpose of providing EPA and the public with a summary of citizen comments and concerns about the site, and EPA's responses to those concerns. A summary of comments received during the public comment period is provided in Section III. All of the comments summarized in this document will be factored into EPA's final decision of the preferred alternative for cleanup of the Katonah Municipal Well.

This community relations responsiveness summary for the Katonah Municipal Well site is divided into the following sections:

I. Responsiveness Summary Overview. This section briefly outlines the proposed remedial alternatives as presented in EPA's draft FS, including the preferred alternative.

II. Background on Community Involvement and Concerns. This section provides a brief history of community interest in the Katonah Municipal Well site and a chronology of community relations activities conducted by EPA during remedial activities.

III. Summary of Major Questions and Comments Received During the Public Comment Period and EPA Responses to Comments. This section summarizes major questions and comments made verbally and in writing to EPA during the public meeting and public comment period, and provides EPA responses to these comments.

IV. Remaining Concerns. This section discusses community concerns about the RI/FS that were not directly addressed during the RI/FS and that EPA should consider in planning for, and conducting the remedial design and remedial action for the Katonah Municipal Well site.

I. RESPONSIVENESS SUMMARY OVERVIEW

The Katonah Municipal Well Site is located in the Village of Katonah in the Town of Bedford in northeastern Westchester County, New York. During the Fall of 1978, the Westchester County Department of Health (WCDH) surveyed drinking water wells in Armonk, Mount Kisco, Bedford, and Katonah, following the discovery of contaminants in the well supplying drinking water to the City of Brewster, New York. Initial efforts to identify and characterize the contaminants were a joint effort between WCDH and the New York State Department of Environmental Conservation (NYSDEC). NYSDEC traced the contamination detected in the Brewster well to the disposal site of a septic waste hauler. NYSDEC discovered that the waste hauler had also collected septic wastes containing volatile organic compounds (VOCs) from a location in Katonah. Based on this discovery, NYSDEC officials then decided to investigate the possibility of similar contamination in Katonah. NYSDEC's investigation revealed the presence of contaminants in samples taken from the Katonah well. Subsequently, the Katonah Municipal Well was closed in December 1978 and has been out of service since that time except for brief periods in 1979, 1981, 1985, and 1987 when water samples were collected for analysis.

The Katonah Municipal Well is an EPA fund lead site and was included on the National Priority List (NPL) of Superfund sites in October 1984. Following placement of the Katonah Municipal Well on the NPL, EPA assumed responsibility for clean-up of site contamination. In June of 1985, EPA began the RI/FS of the Katonah Municipal Well. The objectives of the RI/FS were to determine the nature and extent of contamination affecting the Katonah Municipal Well, and to evaluate potential cleanup remedies. The RI/FS was conducted in two phases. The need for a phased approach resulted from extensive data gaps in areas such as hydrogeology and source characterization. Both phases of the RI/FS were completed in June 1987.

Results of the RI indicated that the primary contaminants of concern at the site included tetrachloroethylene (PCE), trichloroethylene (TCE), and metals such as lead, nickel, and zinc.

The draft RI/FS describes several remedial alternatives that are judged by EPA to be the most effective for dealing with site contamination. These are briefly summarized below.

Alternative 1: No Action.

Under the no-action alternative, the site would remain in its present condition with no reduction of contamination or risk. However, the well would remain closed and the primary risk via ingestion of contaminated groundwater would be eliminated.

Alternatives 2 & 3: Excavation and Off-Site Disposal/Incineration of Soils.

Alternatives 2 and 3 involve excavation of contaminated soils beneath the pumphouse. The only distinction between alternatives 2 and 3 is the method of disposal. The first method considers disposal off-site in a secured landfill. Alternative 3 considers destruction of contaminants through off-site soil incineration. This method involves significantly higher costs but would satisfy the intent of the Superfund Amendments and Reauthorization Act favoring permanent solutions.

Alternative 4: Containment of Contaminated Soil and Groundwater.

Alternative 4 addresses containment of contaminated soil and groundwater. It includes the installation of four purge wells that would be placed upgradient from the peninsula, upon which the Katonah Well is situated. These wells would be used to extract contaminated groundwater, which would then be treated to remove both inorganic and organic compounds that may exceed drinking water standards. The treatment system would employ air stripping, granular activated carbon and chemical precipitation. The first two methods are for removal of organic compounds detected in area groundwater and the latter removes metals that were detected in some monitoring wells at high levels.

Alternative 5: Replacement of the Lost Water Resource with No Site Remediation.

Alternative 5 provides for the installation of a new well in an area of town unaffected by contamination. This well would then be connected to the existing distribution system. Soil and groundwater in the vicinity of the existing Katonah Well would not be remediated.

Alternative 6: Installation of a New Production Well Facility and On-Site Treatment with an Air Stripper.

Alternative 6 involves installation of a new well near the Katonah Well and on-site treatment of water from the new well with an air stripper. This treatment system would remove the contaminants detected in the Katonah Well to levels above drinking water standards.

Alternative 7: Renovation of the Existing Well and On-Site Treatment with an Air Stripper.

Alternative 7 includes renovation of the existing Katonah Well and on-site treatment of well water with an air stripper.

All of the alternatives discussed above, except for the no-action alternative, include a comprehensive groundwater monitoring program, designed to ensure a safe drinking water source for the community.

Technologies utilized in the above-listed alternatives include:

- **Excavation:** the physical removal of contaminated soils. These soils may then be disposed at an approved off-site landfill facility, or off-site incinerator.

- **Containment:** the extraction of groundwater from the well, the removal of top soil, and placement of a synthetic liner in the excavated area with clean fill used to replace the removed contaminated soil.

- **Replacement:** the actual drilling of a new well in another location.

- **Renovation:** restoration of the existing well to the most efficient conditions utilizing various treatments or reconstruction methods.

- **Air stripping:** this involves passing air through a column with a counterflow of contaminated water to cause volatilization of volatile organic compounds in the contaminated water.

PREFERRED ALTERNATIVE

After careful evaluation of the remedial alternatives, EPA has selected Alternative 6: Installation of a New Well and On-Site Treatment with an Air Stripper as the preferred remedial alternative for the Katonah Well Site.

This alternative involves the installation of a new production well facility near the present Katonah well, and on-site treatment of water from the new well with an air stripper. This treatment system would remove the contaminants detected in the Katonah well to levels which exceed minimum health and safety standards established for drinking water.

II. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

Community concern regarding the Katonah Municipal Well site has been extremely low, and has diminished since the closing of the well and development of an alternate water supply in 1978. The perception among residents is that this alternate water supply has substantially mitigated the problem at the Katonah Municipal Well. However, in April 1986, when EPA conducted on-site interviews in the Katonah community, the following specific areas of concern were identified by local officials and the site community.

Physical and Financial Impact on Katonah's Commercial Center. Due to the proximity of the well to Katonah's central business district, local officials have expressed concern over the potential impact that site work may have on parking, commuter and traffic patterns, and resultant effects on local businesses.

Relationship of the Katonah Well to the Current Municipal Water Supply. Village officials are concerned that activity at the Katonah Well Site may generate renewed interest from residents regarding the town's current source of drinking water. Concern focuses on the perception that residents may question the quality of the current municipal water supply if they perceive a link with the Katonah Well.

Federal, State, and County Jurisdictional Issues. Local citizen leaders have expressed a degree of confusion regarding roles and responsibilities of the different levels of government involved in the sampling and monitoring of private residential wells in Bedford Village.

During EPA's remedial site activities, several site-specific community relations activities have occurred as part of EPA's overall site community relations program. These activities are briefly summarized below.

- A fact sheet was developed and sent to community members in April 1986, prior to the initiation of the RI/FS. The purpose of this fact sheet was to provide interested residents with information on site background; nature of the contamination problem at the Katonah Municipal Well site; EPA's site investigation activities; plans for future EPA site activities, and the Superfund process in general.

- In April 1986, EPA conducted on-site interviews, and, as a result, developed a site-specific community relations plan for conducting community relations activities at the site throughout the RI/FS.

- A field information handout, which explained the purpose of the RI/FS at the Katonah Well, and announced public availability sessions, was developed by EPA and distributed to interested citizens. EPA held a public briefing in April 1986 to explain the purpose of the RI/FS. Approximately 15 people attended this public briefing. Following this briefing, EPA conducted two public availability sessions.

- In December 1986, EPA and it's contractor personnel, met with representatives from the New York State Department of Environmental Conservation (NYSDEC); the New York City Department of Environmental Protection (NYCDEP); the Westchester County Department of Health (WCDH), and local officials from the Town of Bedford. The purpose of this meeting was to present the results of Phase I of the RI, and to discuss proposed site activities for Phase II.

- On July 29, 1987, a public notice announcing the public comment period and upcoming public meeting, was published in the White Plains, New York, Reporter Dispatch. EPA developed and distributed an additional fact sheet, which outlined the remedial alternatives and identified EPA's preferred remedial alternative. EPA held a public meeting on August 5, 1987 to provide information on EPA's preferred remedial alternative, the proposed remedial action plan, and to answer any questions pertaining to the site. Local officials representing the community attended the public meeting on the RI/FS.

III. SUMMARY OF MAJOR QUESTIONS AND COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA's RESPONSES TO COMMENTS.

A public comment period was held from July 27, 1987 through August 20, 1987 to receive comments from the public on the draft FS and EPA's preferred remedial alternative for the Katonah Municipal Well site. The public meeting for the Katonah Municipal Well site was held on August 5, 1987 at 7:00 p.m. at the Bedford Hills Town Hall, Bedford Hills, New York. The meeting, was attended by four EPA officials, three members of EPA's contractor staff, and four local officials. The purpose of the meeting was to present and discuss the draft FS for the Katonah Well site, to apprise local officials and interested residents of the agency's preferred alternative for remediation of the site contamination, and to provide an opportunity for interested parties to present oral comments and questions to EPA. These comments are recorded in a transcript of the meeting which is available for review at EPA's regional office in New York City and the information repositories located in Bedford Hills and Katonah. Comments received during the comment period are categorized below by topic:

A. Liability of potentially responsible parties; (PRP's) and apportionment of liability.

B. Origin, nature, and extent of contaminants, and

C. Other concerns.

A. LIABILITY OF POTENTIALLY RESPONSIBLE PARTIES

1. COMMENT: A local official requested information regarding the Town of Bedford being named as a PRP and asked who would conduct negotiations concerning determination of liability.

   EPA RESPONSE: Liability determination would be up to town attorneys and the EPA Region II legal staff. EPA will notify the town of how the agency wishes to proceed with legal issues, and indicate whether the agency feels there is any liability on the part of the town.

2. COMMENT: A local official expressed concern that the town would be required to legally pursue a PRP and implement a remedial action if no legal action was taken by EPA, and wanted information on how financial liability would be apportioned if multiple PRPs are identified.

   EPA RESPONSE: EPA has already notified a potential PRP other than the town. If the town were to conduct and implement the remedial design, implementation of a remedial action would be accomplished through an administrative order. If this order was signed with EPA, the town would then have legal authority, and the power to exercise that authority, in pursuit of a PRP. EPA would aid the town in providing technical expertise, and determination of degree of PRP liability. It is difficult to determine apportionment of liability. However, if the town were to sign such an order, the legal pursuit of additional PRPs would then become an option that the town may wish to consider. Upon further

discussion with EPA's legal staff, it has been determined that the ability of the town to pursue legal action regarding additional PRPs would remain intact.

3. COMMENT: A local official inquired as to EPA's availability for possible court appearances regarding determination of a PRP.

EPA RESPONSE: A comprehensive administrative record, which incorporates all data utilized in formulating a decision for this site, would be available for use in any litigation. That is the purpose of this administrative record.

4. COMMENT: A local official asked whether there would be any legal briefing before signing of an administrative order.

EPA RESPONSE: Any legal discussions would be conducted by EPA attorneys. Upon the signing of an administrative order by the town, EPA's direct involvement would diminish and the town would assume primary responsibility from that point regarding legal action against any additional PRPs. EPA's legal staff would not be involved with any decisions made by the town regarding a PRP.

5. COMMENT: An official inquired as to what assistance EPA would provide to the town regarding its role in the signing of an administrative order.

EPA RESPONSE: Assistance regarding the signing of an administrative order and definition of the town's role in the order would be provided by EPA enforcement personnel and legal staff.

6. COMMENT: A local official expressed concern over procedures regarding apportionment of funding among multiple PRPs.

EPA RESPONSE: There is a provision in the Superfund law dealing with mixed funding among multiple PRPs. This is a relatively new provision and this issue should be dealt with by EPA's legal staff. If all PRPs were contacted, EPA would assist the town in liability apportionment. However, if these PRPs did not voluntarily assume liability, the agency is not in a position to compel a PRP to assume this liability. The rationale behind pursuit of a PRP is to recover costs incurred by EPA in conducting studies related to a particular site. If a PRP is identified and is financially unable to assume liability, it is unlikely that the agency would legally pursue recovery of costs.

7. COMMENT: A local official inquired as to the scheduling of notifications to PRPs.

EPA RESPONSE: Identified PRPs will be notified by the end of August 1987. The record of decision will be signed as soon as possible following this notification.

B. ORIGIN, NATURE, AND EXTENT OF CONTAMINANTS

1. COMMENT: A local official expressed concern over the type, amounts, and location of detected contaminants.

EPA RESPONSE: PCE and TCE, which are used as industrial solvents and degreasers, were found at low levels near a local dry cleaning establishment. These were also found at trace levels in a monitoring well in the same area. There were also low levels of these chemicals detected in the soil at the level of the well pump. The highest concentrations were detected in Well W-9, which is located directly in front of the pumphouse. PCE was detected at 36 parts per billion. In contrast, a recognized acceptable level of PCE contamination is less than 5 parts per billion.

2. COMMENT: A Town official inquired as to the amounts of detected contaminants which precipitated the closing of the well in 1978, and whether it was standard practice to close a well based on these amounts.

EPA RESPONSE: When combined, the total contamination level exceeded 100 parts per billion (ppb), which is a sufficient amount to close the well. The PCE level alone exceeded 50 ppb, which is, in itself, a high enough level of contamination to warrant closing of the well. PCBs were detected in Well W-8 upon two separate sampling events. However, the amount of PCBs detected was low, and not found in subsequent sampling. PCB is insoluble and tends to cling to soil particles. It was unusual that PCBs were not detected in subsequent sampling.

3. COMMENT: A local official expressed concern over the origin of metals contamination such as lead, nickel, and zinc, and whether the detection of hydrocarbons added to well contamination.

EPA RESPONSE: The origin of these contaminants has not been determined. Lead is a component of gasoline and the town has demonstrated a record of dumping street cleaning debris near the well. Hydrocarbons were not detected in the well.

C. OTHER CONCERNS

1. COMMENT: A local official asked about the source of water coming into the municipal well and whether PCE was detected below the level of the water table.

EPA RESPONSE: Approximately eighty percent of the well recharge water comes from the reservoir. This is a number used in modelling efforts and not intended to be exact. It does, however, establish a general guideline to determine how much water is drawn from the reservoir to replenish the well as well water is being used. PCE was detected in the groundwater in all sampling locations except for the pumphouse.

IV. REMAINING CONCERNS

This section describes additional community concerns that EPA should be aware of in preparing to undertake the remedial design and remedial action at the Katonah Municipal Well site.

- Roles and Responsibilities of PRPs. Concern has been expressed regarding the roles and responsibilities of any identified PRPs. Concern focuses on the apportionment of liability among multiple PRPs, if and when identified, and what responsibilities the town may incur following PRP identification.

- Enforcement Actions. Local officials should be kept informed as to the progress of any enforcement action taken by the agency.

- Site Activity During the Remedial Design/Remedial Action Phase. Future remedial design activities may generate renewed interest in the Katonah Municipal Well problem. The community should be informed as to the schedule, type, and duration of these activities to ensure that expressed concerns by residents and local officials continue to be addressed.

In addition, the three community relations issues identified in the community relations plan for this site, and described on pages 4 and 5 of this responsiveness summary will continue to be issues that EPA should be aware of throughout remedial design activities.

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Katonah Municipal Well, Town of Bedford, Westchester County, New York

STATEMENT OF PURPOSE

This decision document represents the selected remedial action for the Katonah Municipal Well site, developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC §9601, et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300, November 20, 1985.

STATEMENT OF BASIS

This decision is based on the administrative record for the Katonah Municipal Well site. A copy of the record is available for review at the information repository for the site and at the regional office. The following documents, which are part of the administrative record, were primarily relied upon in making this decision:

- Draft Remedial Investigation Report, Katonah Municipal Well Site, prepared by Camp Dresser and McKee, Inc., July 1987
- Draft Feasibility Study Report, Katonah Municipal Well Site, prepared by Camp Dresser and McKee, Inc., July 1987
- Proposed Remedial Action Plan, Katonah Municipal Well Site, July 1987
- The attached Summary of Remedial Alternative Selection for the Katonah Municipal Well site
- The attached Responsiveness Summary for the site, which incorporates any public comments received
- Staff summaries and recommendations

DESCRIPTION OF SELECTED REMEDY

This Record of Decision (ROD) for the Katonah Municipal Well site calls for the following actions, which address public water supply and aquifer remediation.

o A new production well will be installed on the peninsula owned by the City of New York, designed for a rated capacity of 370 gallons per minute (gpm). The existing Katonah well will be filled and sealed to mitigate the possibility of contaminants entering the aquifer by natural or other means and to prevent future use of untreated ground water.

o A new water treatment facility will be installed on the peninsula, designed to treat the rated capacity of the

production well. Treatment processes will include an air stripper and disinfection. Treated water will be discharged to the Bedford Consolidated Water District distribution system, to be used for drinking water by the community.

- A monitoring program designed to detect the presence of identified contaminants in the treated water will be required. The results of this monitoring program will be evaluated on a routine basis to ensure protection of human health.

- A general clean up of the peninsula area to remove trash and debris, which may adversely affect water quality in the future, is recommended for Town implementation. Also, past practices of using the peninsula area as a convenient dumping area for debris and other potentially hazardous material should be discontinued.

DECLARATIONS

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate and is cost effective. This remedy satisfies the preference for treatment that reduces the toxicity, mobility, or volume of hazardous substances, pollutants or contaminants as a principal element. Finally, it is determined that this remedy utilizes permanent solutions and alternative treatment to the maximum extent practicable.

The action will require future operation and maintenance activities to ensure the continued effectiveness of the remedy. The start-up activities, which will ensure the operational effectiveness of the design, will be considered part of the approved remedial action and eligible for Superfund monies for a period of up to one year. The remainder of the activities are considered operation and maintenance and are therefore the responsibility of New York State.

The State of New York has been consulted and agrees with the approved remedy (see attached letter).

I have also determined that the action being taken will be appropriate when balanced against the future availability of Trust Fund monies for use at other sites.

September 25, 1987
Date

Christopher J. Daggett
Regional Administrator

TABLE OF CONTENTS

		PAGE
I.	SITE LOCATION AND DESCRIPTION	1
II.	SITE HISTORY	1
A.	Current Site Status	2
B.	Risk Assessment	2
	Contaminants of Concern	3
	Exposure Pathways	4
	Risk Characterization	4
	Environmental Impacts	5
III.	ENFORCEMENT ANALYSIS	5
IV.	COMMUNITY RELATIONS	5
V.	ALTERNATIVES EVALUATION	6
VI.	SELECTED REMEDY	10
VII.	FIGURES	13
VIII.	TABLES	22

ATTACHMENTS

A - NYSDEC Letter of Concurrence

B - Responsiveness Summary

FIGURES

FIGURE		PAGE
1	Site Location Map	13
2	Site Layout Map	14
3	Location of Stratographic Cross Sections.	15
4	Stratographic Cross Section A-A	16
5	Stratographic Cross Section B-B	17
6	Observed PCE Concentration in Katonah Well During Pumping.	18
7	Ground Water Flow Without Pumping	19
8	Ground Water Flow With Pumping.	20
9	Contaminated Flow Paths under Pumping and Non Pumping Conditions.	21

TABLES

TABLE	PAGE
1 - Cost Information for Remedial Alternatives.	22
2 - Design Information for Selected Remedy.	23

I. SITE LOCATION AND DESCRIPTION

The Katonah Municipal Well site is located in the Village of Katonah in the Town of Bedford, Westchester County, New York, on land owned by the City of New York (NYC). (See Figure 1.) The Katonah Well is situated on a peninsula that extends into the Muscoot Reservoir, part of the Croton Reservoir system. (See Figure 2.) The well was designed in the early part of this century as an infiltration gallery, drawing water primarily from the reservoir, with some contribution from the aquifer underlying the Village.

The Village of Katonah is moderately populated, with local zoning policy allowing for less than one acre development. The Village is underlain by a glacial stratified drift aquifer, that receives waste discharge from local septic systems. (See Figures 3 - 5.)

II. SITE HISTORY

During the fall of 1978, the Westchester County Department of Health (WCDH) surveyed the water quality of municipal wells in Armonk, Mount Kisco, Bedford and Katonah. This survey was undertaken after the Putnam County Health Department discovered contamination in the Brewster Wellfield. The contamination was traced to the disposal facility of a local septic waste collector by the New York State Department of Environmental Conservation (NYSDEC). Further investigation revealed that the operator of this facility had collected wastes from septic systems of dry cleaners located in the Village of Katonah. Samples from some of these septic systems revealed the presence of tetrachloroethylene (PCE). The WCDH then sampled the Katonah Well and detected the presence of several halogenated organic compounds including, tetrachloroethylene, dibromochloromethane, bromodichloromethane and bromoform. The well was closed and the Town temporarily interconnected with the Bedford Correctional Facility Water System to restore water to the 6200 people dependent upon the Katonah Well for over sixty percent of their supply.

Source control was implemented by the WCDH in 1978. The dry cleaners were required to pump out their septic systems and modify their disposal techniques for waste solvents. Additional source control measures were implemented by the Town of Bedford through the promulgation of stringent aquifer protection ordinances that regulate waste discharges to Town aquifers.

Initial attempts by the Town and the WCDH to remove the contamination from the aquifer failed. These included pumping the well to waste and raising the stage of the Muscoot Reservoir to dilute the concentration of contaminants in the Katonah Well by increasing the contribution of clean reservoir water. The site was then referred to the NYSDEC for preliminary assessment and site investigation. These efforts caused the site to be proposed for the National Priorities List (NPL)

in October 1984. NYSDEC entered into an agreement with USEPA and the site was designated for a Federal lead, remedial investigation/feasibility study (RI/FS) to determine the nature and extent of contamination and to develop long term remedial alternatives to clean up the contamination. In June 1985, USEPA procured the services of Camp Dresser and McKee Inc. to perform the RI/FS.

A. Current Site Status

USEPA completed an RI/FS for the Katonah Municipal Well in July 1987. Contaminant sources, transport, receptors and potential risks are evaluated in the reports documenting the results of these studies. The following is a brief summary of the types and concentrations of contaminants detected at the site.

A number of hazardous substances were detected in groundwater monitoring wells, soil borings, and surface water and sediment samples collected during the remedial investigation. For the most part, their appearance was erratic between sampling events and locations. Only tetrachloroethylene (PCE), the original contaminant of concern, appeared somewhat consistently in the sampling data collected during the RI. Further, only PCE was detected in the Katonah Well effluent at levels that exceed standards established for the site.

There is currently no Federal or State standard for PCE. There is a New York State Department of Health (NYSDOH) guideline value of 50 ug/l for any single volatile organic compound, a NYSDEC Technical and Operational Guidance Series (TOGS) value of 0.7 ug/l, and a Federal Water Quality Criteria value of 0.8 ug/l. The highest value of PCE found in groundwater during the RI was 36 ug/l, found in monitoring well W-9, located on the peninsula. The highest value of PCE found in any soil sample was 81 ug/kg, found in soil boring B-3, located near a dry cleaners septic system.

A four week pump test of the Katonah Well was performed to delineate its hydrogeologic influence on local surface and ground water and to characterize present effluent water quality. PCE was not detected in the well initially, however, the concentration increased with time and leveled off at approximately 20 ug/l after three weeks of pumping. This trend corresponded with the results of a pump test carried out in 1981 by the WCDH. However, at that time the concentration of PCE detected in the well's discharge leveled off at approximately 75 ug/l. (See Figure 6.) This significant decrease in concentration over time is probably the result of natural attenuation and possibly some biodegradation. It also indicates that aquifer restoration may be possible over time and may be enhanced by pumping.

B. Risk Assessment

The primary potential human health impact at the Katonah site is

through ingestion of contaminated groundwater. In order to assess the level of risk associated with the contamination, a risk assessment was conducted. This assessment provides a quantitative estimate of risk levels under existing conditions, in the absence of remedial action. This is used to determine whether remedial action at the site is warranted. The risk assessment was developed as follows: identify contaminants of concern; describe pathways of exposure associated with site contaminants; estimate levels of exposure and determine populations affected; and characterize current and potential risks to human health and the environment.

Contaminants of Concern

Two separate risk assessments were performed on chemicals identified in the RI. The first utilized data from the Katonah Well collected during the course of a four week pump test. The second scenario evaluated risks from ingestion of ground water containing concentrations of chemicals of concern that were collected from monitoring wells under non-pumping conditions. The excess cancer risk associated with groundwater use exceeded 10^{-6} under both scenarios. This means that one might expect greater than one additional incidence of cancer in a hypothetical population of 1,000,000 people resulting from ingestion of contaminated ground water.

The first scenario focusing on analytical results from the numerous sampling events conducted on effluent water from the Katonah Well represents actual ground water ingestion data. The only chemical of concern detected during any sampling event exceeding the excess cancer risk level of 10^{-6} was tetrachloroethylene (PCE). The associated excess cancer risk for ingestion of Katonah Well water contaminated with PCE at a level of 20 ug/l is 10^{-5}. There was no statistical difference in the excess cancer risk values obtained using maximum concentrations versus those obtained using a geometric mean.

The second scenario incorporated data from the nine monitoring wells installed during the RI. It was incorporated into the risk assessment to represent the potential worst case scenario, involving increased risk of cancer from ingestion of ground water. This scenario attempts to simulate the conditions that might exist if the reservoir stage were lowered, thereby decreasing its contribution to the well and increasing the percentage of water derived from area ground water. This data was collected during static conditions and demonstrated significant fluctuations between sampling events and locations. Five organic compounds, along with arsenic, were identified as contributing to excess cancer risk.

The five organic chemicals contributing to excess cancer risk under the second scenario include benzene, bis(2-ethylhexyl) phthalate, polychlorinated biphenyls, tetrachloroethylene, and

trichloroethene. Benzene was detected during only one sampling event at a level exceeding the MCL of 5 ug/l. Bis(2ethylhexyl) phthalate is a common lab contaminant and was detected at levels significantly lower than the guideline Federal Water Quality Criteria value for human health of 15 mg/l. PCBs were detected in only one monitoring well during one sampling event. Also, the monitoring well was installed in a borehole and corresponding split spoon samples taken from this location failed to reveal the presence of PCBs. PCBs are relatively insoluble in water, tending to adsorb to soils. Thus, the presence of this chemical is suspect.

Arsenic was the primary contaminant of concern driving the excess cancer risk under the second scenario. However, its presence at levels that correspond with an excess cancer risk greater than 10^{-6} in certain monitoring well locations during particular sampling events can probably be attributed to a sampling procedure not in accordance with standard methods for sampling inorganics. Monitoring well samples for inorganics were not filtered and were preserved by lowering the pH to 2, to preserve metals. This procedure would release metals such as arsenic from solids present in the sample that would not normally be associated with ground water ingestion from a properly developed production well. The monitoring program to be established during the remedial design will verify this conclusion.

Exposure Pathways

Based upon the results of the endangerment assessment contained in the RI report, it has been determined that ingestion of contaminated ground water poses the greatest human health risk at the Katonah Municipal Well site. Ground water flows underneath the Village of Katonah and discharges into the Muscoot Reservoir. There are no residential wells in the flow path, other than the Katonah Well. Local ordinance requires that all residences in the vicinity tie into the municipal water supply system. The only chemical detected in the Katonah Well at a level exceeding standards established for the site is tetrachloroethylene (PCE).

Risk Characteristics

Available analytical data from the Katonah Well indicates that there is an excess cancer risk of 10^{-5} associated with ingestion of water from the Katonah Well. Monitoring well data indicates that there is some potential carcinogenic risk associated with four additional organic compounds and arsenic. However, the data was erratic. Any risk derived from this data incorporates this uncertainty and assumes that ground water of the quality observed in some monitoring locations at particular times will reach the Katonah Well and be ingested. To ensure a continued safe drinking water supply for the community, as part of the selected remedial alternative, a long term monitoring

program will be proposed and will scan for identified site contaminants.

Environmental Impacts

Potential environmental impacts from the contamination affecting the Katonah Well are limited in scope and degree. Low level, ubiquitous contamination of the aquifer was revealed during the RI. The only chemical that appeared consistently in sampling results was PCE. The only potentially affected surface waters in the area are the Katonah Brook and the Muscoot Reservoir. These have been sampled since the discovery of contamination in the Katonah Well and were resampled six times each during the RI. They have not been affected by the contamination and the potential for future contamination is highly improbable.

III. ENFORCEMENT

General notice letters were sent to four dry cleaners and three property owners on April 19, 1985 identifying them as Potentially Responsible Parties (PRPs) under Section 107 (a) of CERCLA for the contamination at the Katonah Municipal Well site. In their respective responses to our notice letters, none of the PRPs expressed an interest in conducting the RI/FS. EPA therefore funded the study in July 1985.

A special notice letter was sent to the Town of Bedford on September 2, 1982, in addition to the PRPs who previously received general notice. Sampling data confirmed statements by the Foreman of the Bedford Consolidated Water District that Town employees had dumped waste solvents down a drain located in a pumphouse less than 100 feet from the Katonah Well.

IV. COMMUNITY RELATIONS

Community involvement was solicited early in the RI/FS process at the Katonah Municipal Well site. A public meeting was held on April 23, 1986 to identify areas of community concern and to provide an opportunity for public participation. Only Town officials and a potentially responsible party attended. Another public meeting was held August 5, 1987 to discuss the results of the RI/FS and to present EPA's preferred remedial alternative. Once again, attendance was limited to Town officials.

Bedford officials characterize the contamination at the Katonah Well site as an old problem, long forgotten by most residents of Bedford. Local officials have received few complaints or queries regarding the site since the well was shut down in 1978. They attribute this to the fact that the well was closed immediately after contamination was discovered.

Specific concerns raised during the public comment period,

including comments made at the public meeting held on August 5, 1987, at the Bedford Town Hall, are addressed in the attached Responsiveness Summary. A transcript of the public meeting is available in the Administrative Record, located at the information repository and the regional office.

V. ALTERNATIVES EVALUATION

The remedial alternatives for the Katonah Municipal Well site were developed and evaluated using the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC §9601, et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300, and the "Guidance on Feasibility Studies Under CERCLA", as guidance.

Seven remedial alternatives were presented in the FS by Camp Dresser and McKee Inc., with five of these containing two subcategories, generally distinguishing between methods of disposal for excavated materials. USEPA issued a Proposed Remedial Action Plan (PRAP) in July 1987 to solicit public comment upon the agency's preferred alternative. The PRAP restructured the remedial alternatives presented in the FS. Excavation was broken out as a separate alternative and the monitoring program was removed from the no action alternative. In addition, capital costs were reduced to reflect the extraction of excavation as a separate alternative and the removal of other items deemed unnecessary for the successful implementation and cost effectiveness of the remedial alternatives. Alternatives will henceforth be presented as in the PRAP. All information regarding the alternatives presented in the PRAP has been extracted from the FS and is easily discernible.

The seven remedial alternatives documented in the PRAP, and their associated capital costs, operation and maintenance present worth costs, and total present worth costs are provided in Table 1.

Alternative 1: No Action

The no action alternative would leave the site in its present condition with no reduction of contamination other than through natural attenuation. However, the Katonah Well would remain closed and the primary risk via ingestion of contaminated groundwater would be eliminated. This alternative would result in the loss of this aquifer system as a water resource for the community. It would involve placing restrictions on water use in the area and would not address aquifer restoration.

Alternatives 2 and 3: Excavation of Soils and Off Site Disposal

Alternatives 2 and 3, as delineated in the PRAP address removal of contaminated peninsula soils by excavation. These alternatives propose the removal of approximately 1000 cubic yards of soil underneath the existing pumphouse. This possible source of contamination to the Katonah Well was revealed by a Town employee. Analytical results on soil samples from the pumphouse drain revealed the presence of chloroform at 11,000 ug/kg and several other organic compounds at levels below Contract Laboratory Program (CLP) detection limits in the upper portion of the drain. A soil boring down this drain revealed the presence of chloroform at 200 ug/kg and chlordane at 440 ug/kg in a split spoon sample taken from three to five feet below the top of the drain. Other organic compounds were detected in split spoon samples from this borehole at levels below CLP established detection limits.

Excavation materials in alternative 2 that are determined to be hazardous would be disposed of in a RCRA approved facility. However, implementation of this alternative without pretreatment would probably be precluded by the Congressionally imposed land ban date of November 1988. Alternative 3 would dispose of contaminated soils by off site incineration, satisfying the statutory prerogative favoring permanent remedies and use of alternative treatment technologies to the maximum extent practicable. However, excavation under either alternative is not warranted given the low levels of contamination and the results of a four week pump test conducted during the RI.

The organic compounds detected in the soil boring beneath the pumphouse drain are present in low levels, except for chloroform. They have not been detected in numerous ground water sampling events at any location and were not detected at any time in the Katonah Well during a four week pump test conducted during the RI or in the many historical sampling events conducted on the well by the WCHD and others. Excavation of this material would be a superfluous attempt at source control. Source control measures were implemented by the WCDH in 1978. Efforts were made by the County to work with the dry cleaners to correct problems and remove the sources. Additional source control measures would not contribute to the protectiveness of the remedial action.

In addition, conditions on the peninsula make these alternatives technically impracticable. The peninsula extends into the Muscoot Reservoir and the water table coincides with the water surface of the reservoir. Thus, excavation of soils will require construction of a coffer dam and continuous dewatering of the pit via pumping. These conditions together with sample results dispute the protectiveness, implementability, and cost effectiveness of the proposed excavation alternatives.

Alternative 4: Containment of Contaminated Ground Water and Soil

Alternative 4 addresses containment of contaminated ground water and soil. It includes the installation of five extraction wells that would be placed upgradient from the peninsula, upon which the Katonah Well is situated. These would be designed to intercept contaminated ground water prior to discharge to the Muscoot Reservoir and would be treated for removal of organic and inorganic constituents that may exceed drinking water standards. The treated water would be discharged to the nearby Bedford Consolidated Water District distribution system, to be used as drinking water. The contaminated soil parcel proposed for excavation in alternatives 2 and 3 would be contained through the installation of a synthetic liner and clean cover material.

Containment of the contaminated soil parcel is considered reliable and protective of human health. However, the hydraulic containment of contaminated ground water is not considered to be reliable or technically feasible at the Katonah site. Containment of ground water via purge wells is susceptible to operational and maintenance problems and is vulnerable to extreme fluctuations in natural conditions, such as drought and heavy rainfall, and variations in other relevant design parameters such as changes in the reservoir stage and interruptions in continuous pumping. Also, ground water modeling conducted during the RI indicates that aquifer restoration would not be significantly expedited by the proposed containment system.

The preliminary design in the FS for the treatment facility associated with this ground water containment system was based upon sample results from monitoring wells installed during the RI. Analytical data obtained from samples of some of these wells detected the presence of several inorganic compounds at levels that may exceed standards. However, there were significant fluctuations in the data between sampling events at individual monitoring well locations. The RI attributed the detection of the inorganic constituents to the sampling technique employed. Samples were not filtered and the pH was lowered to 2, to preserve the metals. This procedure would release metals associated with solids in the unfiltered sample. These solids and there associated metals would not normally be present in the discharge of a properly developed production well. The fact that none of these inorganic compounds were detected in the Katonah Well during numerous sampling events offers substantive evidence to support this conclusion.

The treatment facility incorporates metals precipitation processes to remove these inorganic compounds. Operation and maintenance of these type processes is very costly and results in the generation of significant amounts of hazardous sludges that must be disposed of in an appropriate manner. Implementation

of such a system will actually result in an increase in the toxicity and volume of contaminants, counter to the statutory directive requiring a reduction. The alternative is not cost effective because it does not provide additional protection to public health or the environment.

Alternative 5: Replacement of Lost Water Resource With No Site Remediation

Alternative 5 would provide for the relocation of a new well off site. This well would then be connected to the existing distribution system of the Bedford Consolidated Water District. Soil and groundwater on site would not be remediated under this alternative. The alternative is cost effective but does not address aquifer restoration. This alternative will remain implementable to the community, should their future water needs continue to increase. However, the selection of this alternative at this time would basically result in the loss of a prolific water resource. Neither EPA's groundwater protection strategies, nor the community's future water needs would be well served by this alternative. In addition, the statutory directive in CERCLA seeking a reduction of the toxicity, mobility and volume of contamination on Superfund sites would be ignored by the selection of this alternative.

Alternative 6: A New Production Well and Treatment On Site With an Air Stripper

Alternative 6 is the selected remedy for the Katonah Municipal Well site. It provides for the installation of a new production well and on-site treatment with an air stripper prior to discharge into the Bedford Consolidated Water District distribution system for use as drinking water. The treatment system would remove contaminants detected in the Katonah Well at levels that exceed standards established for the site. It will meet drinking water standards and enhance aquifer restoration by pumping and treating contaminated ground water. The remedy will be effective in protecting human health and the environment and in reducing the toxicity, mobility and volume of contamination. It is easily implementable and cost effective. Detailed discussion of the selected remedy is provided later in this document.

Alternative 7: Renovation of the Existing Katonah Well and Treatment On Site With an Air Stripper

Alternative 7 includes a renovation of the existing Katonah Municipal Well and installation of a treatment system identical to that developed for the selected remedy. Although estimated to be slightly cheaper than Alternative 6, this alternative cannot ensure restoration of historical water yields. The results of a four week pump test conducted as part of the remedial investigation indicate that the pumping capacity of the Katonah Well has deteriorated since it was shut down in 1978.

Pumping records from 1978 demonstrated that the well had a pumping capacity of approximately 360 gallons per minute (gpm) at that time. During the 1987 RI pump test the existing Katonah Well demonstrated a maximum yield of 210 gpm.

Reduction in the pumping capacity of the Katonah Well is attributable to deteriorated pumps and to sediment accumulation in the well. The well was constructed over sixty years ago and all available records have been lost. A complete inspection of the well, including a dive to the bottom, was performed as part of the RI. It became apparent that significant renovation of the well and associated pumping facilities will be necessary to obtain historical water yields, including excavation of an additional twelve feet in depth. These requirements hinder the implementability, technical feasibility, and reliability of this alternative.

VI. SELECTED REMEDY

The selected remedial alternative was arrived at by evaluating the remedial alternatives presented in the feasibility study by the consultant Camp Dresser and McKee Inc., in accordance with the statutory requirements established in CERCLA, and to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, cost effective, utilizes alternative treatment technologies to the maximum extent practicable to reduce the toxicity, mobility, and volume of contamination, and attains Federal and State ARARs.

The selected remedy for the Katonah Municipal Well site consists of the following components:

1. A new 370 gpm production well will be installed on the peninsula, owned by the City of New York, near the existing Katonah Well. (See Figure 2.) Contingent upon a detailed design, this well would be drilled to the bottom of the aquifer and screened for approximately one-third of the aquifer thickness. The well will be comprised of a 12-inch stainless steel casing and screen. Two pumps will be installed (one operational and one standby), both capable of delivering water at the required flow rate at a hydraulic head of 300 feet.

2. A ground water treatment facility will be installed on the peninsula, owned by the City of New York. The treatment facility will utilize air stripping for removal of volatile organic compounds and chlorination for disinfection. Treated water will then be discharged to the Bedford Consolidated Water District distribution system for use as drinking water. Contingent upon a detailed design, the design criteria for the treatment facility servicing the 370 gpm production well discharge will be as in Table 2.

Air stripping has been proven effective in removing the contaminant of concern (PCE) to the required level, i.e. less than 1 ug/l, i.e. nondetectable. Also, a treatability test performed during the RI demonstrated the applicability of this alternative treatment technology to the Katonah site. A four week pump test of the Katonah Well was conducted to further characterize hydrogeologic and water quality parameters at the site. Effluent water was treated by an air stripping column, prior to discharge to the Muscoot Reservoir. Monitoring of water influent and effluent to the column demonstrated effective treatability of site ground water by this method. This pilot study further delineated expected water quality for the Katonah site and established that treatment need be provided only for removal of PCE.

3. A comprehensive water quality monitoring program will be initiated to ensure a safe drinking water supply for the community and to determine the level of aquifer restoration. Monitoring locations and schedule will be established during the remedial design stage of the project.

4. A general cleanup of the peninsula area is recommended for Town implementation. This includes the removal of the existing pumphouse facility and any trash, maintenance debris or other material that may adversely affect water quality at the newly installed production well facility. The accumulation of these materials resulted from the poor housekeeping practices maintained by the Town on the peninsula. The continued use of the peninsula as a convenient dumping ground and storage area for these and other possibly hazardous materials should be discontinued.

The selected remedy has been designed as a comprehensive remedial action for the Katonah Municipal Well site. It addresses aquifer restoration by means of pumping and treating contaminated ground water, which will effect aquifer clean up at a more rapid rate than through natural attenuation without pumping. Results of a four week pump test conducted as part of the RI indicate that pumping has significant impact upon contaminant flow paths within the aquifer. (See Figures 7 - 9.) Thus, a pump and treat approach will allow for effective management of contaminant migration in ground water and will prevent the discharge of contaminants to the Muscoot Reservoir.

Target treatment levels and standards have been established for the site and concurrence on these received from the NYSDEC. Contaminated ground water will be treated to drinking water quality and distributed to over 25 consumers on a daily basis. Thus, Maximum Contaminant Levels (MCLs) promulgated under the Safe Drinking Water Act are the applicable or relevant and appropriate cleanup levels for the site. However, there is presently no MCL for the contaminant of concern, PCE.

There is a Federal Water Quality Criteria of 0.8 ug/l (45 FR 79318) associated with a 10^{-6} excess cancer risk for ingestion of water and aquatic organisms. The Superfund Public Health Evaluation Manual (October 1986) associates 0.88 ug/l as the 10^{-6} excess cancer risk threshold for ingestion of water alone.

CERCLA requires the selection of a remedy that is protective of human health and the environment, that is cost effective, and that utilizes permanent solutions or alternative treatment technologies to the maximum extent practicable. The selected remedy, air stripping, is an alternative treatment technology capable of achieving the 10^{-6} excess cancer risk threshold in a cost effective manner. However, generally available analytical techniques offer a detection limit of 1 ug/l for PCE, making compliance with a lower target cleanup level technically impracticable and unenforceable. Thus, in the absence of an MCL, the target treatment level for PCE at the Katonah Municipal Well site will be established as less than 1 ug/l or nondetectable. This treatment level is implementable, protective of human health, and can be achieved in a cost effective manner.

Air emissions from the packed column stripper will consist of extremely low levels of tetrachloroethylene which will pose no threat to human health or the environment. Application of 6 NYCRR 212, commonly referred to as Air Guide 1 was considered applicable or relevant and appropriate in determining acceptable air emission levels for the site. Calculations performed during the RI/FS indicate that expected air emission levels are well below those required by New York State.

Source control was implemented at the Katonah Municipal Well site by the Westchester County Department of Health in 1978. Steps were taken at that time to remove contaminated wastes from the septic systems of area dry cleaners and to modify disposal techniques for waste solvents. Additional source control measures were implemented by the Town of Bedford through the promulgation of stringent aquifer protection ordinances. Contamination presently existing in the aquifer was characterized during the remedial investigation as passive or residual contamination. Further, the RI determined there are no active sources presently releasing PCE to the aquifer.

The selected remedy is protective of human health and the environment, complies with legally applicable or relevant and appropriate requirements in a cost effective manner, and makes use of alternative treatment technologies to the maximum extent practicable. The remedy will pump and treat ground water to provide drinking water for the surrounding community and expedite the reduction and removal of contamination from the aquifer system.

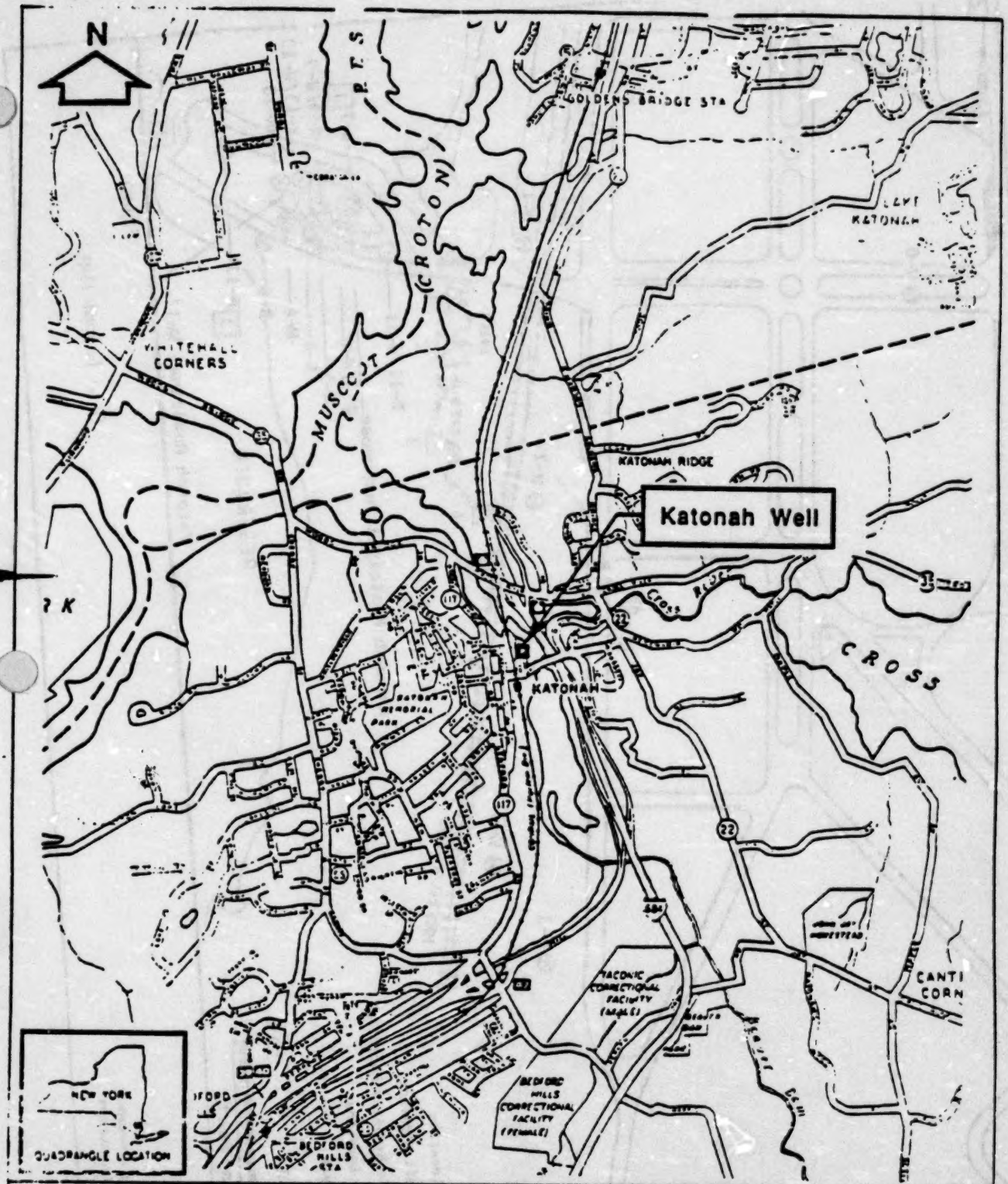

Figure 1

GDM

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Location Map of Katonah Municipal Well Site

Katonah Municipal Well Site, Town of Bedford, New York

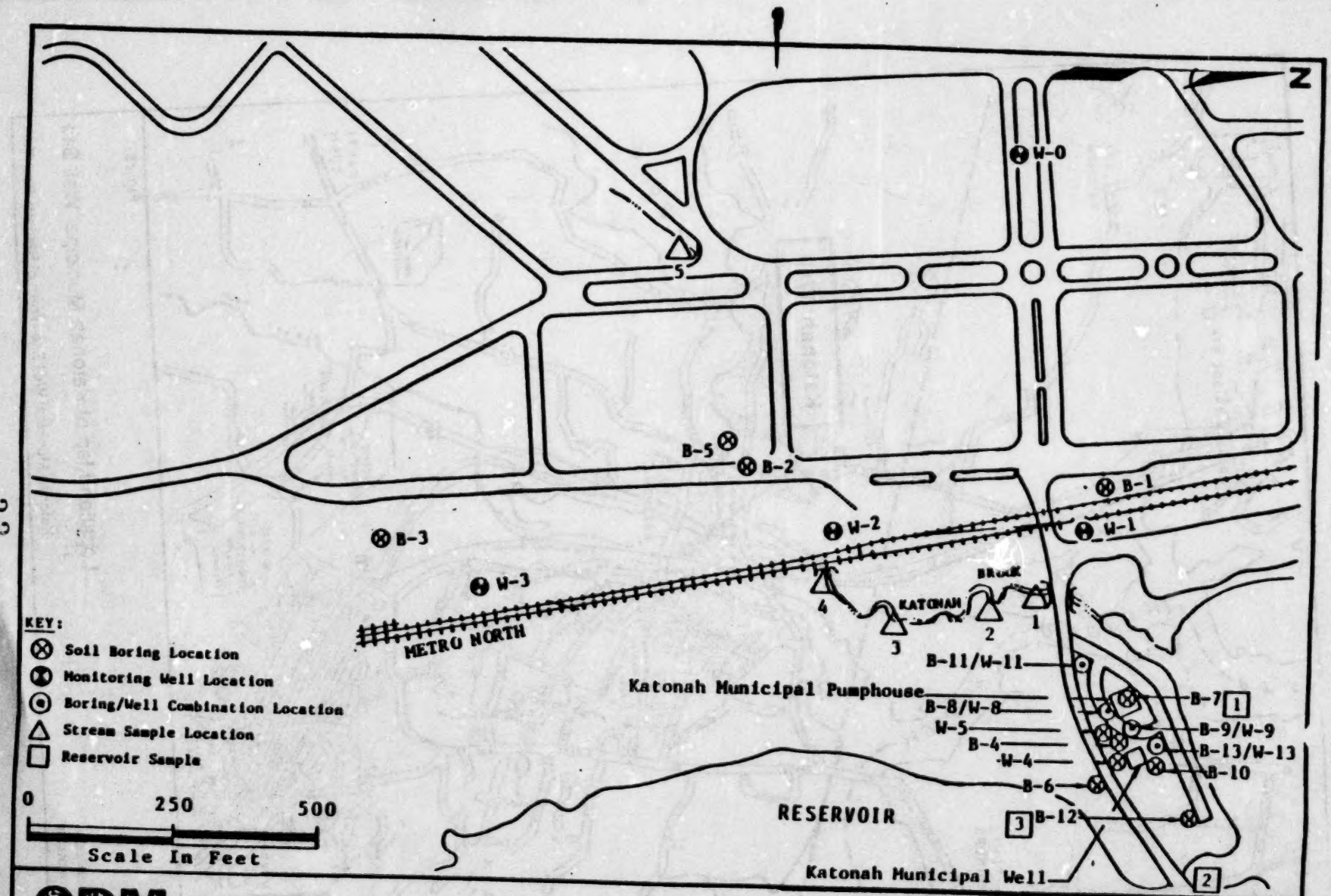

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Figure 2

Site Layout Map

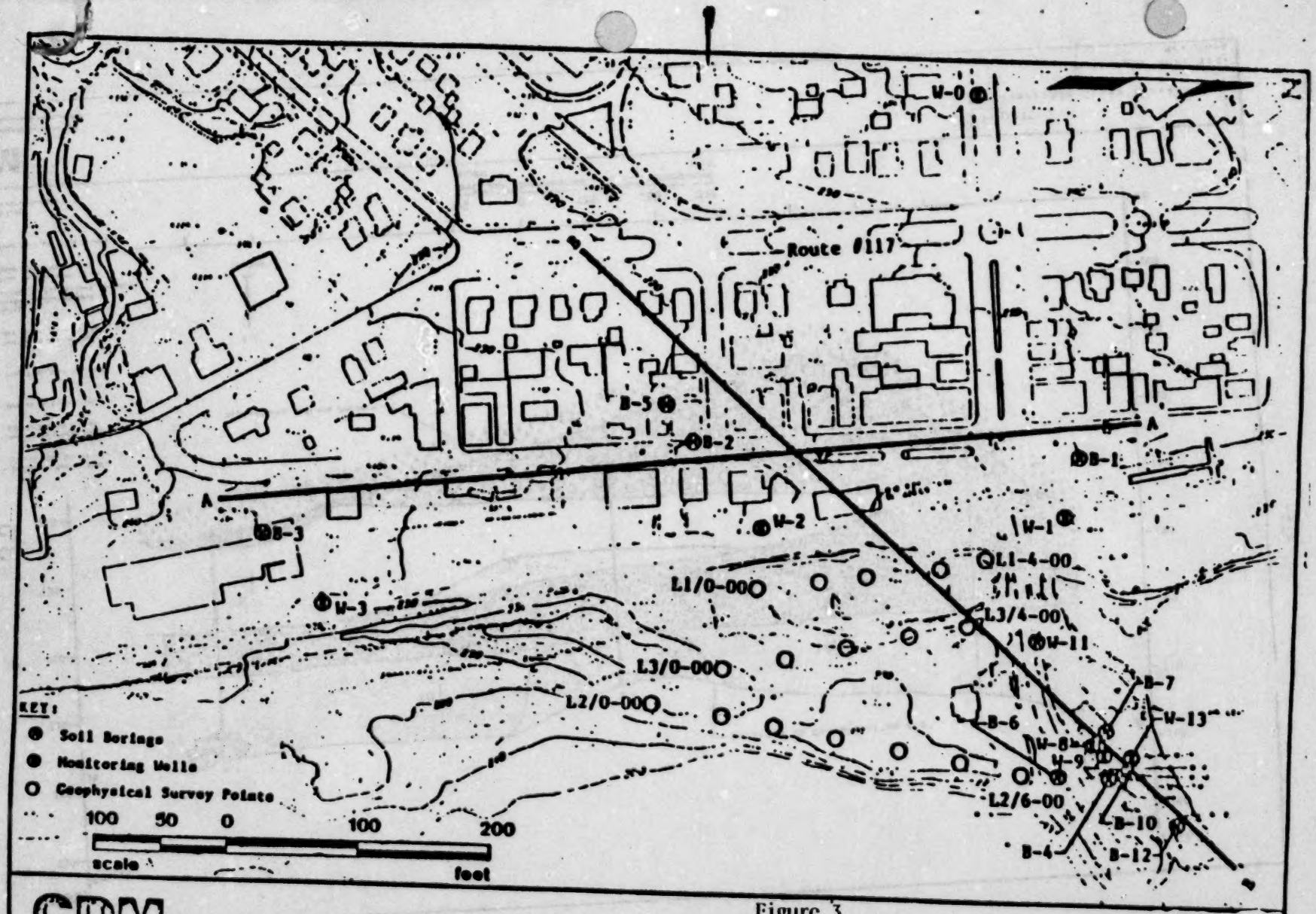

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Figure 3

Location Of Stratigraphic Cross-Sections

Municipal Well Site
New York

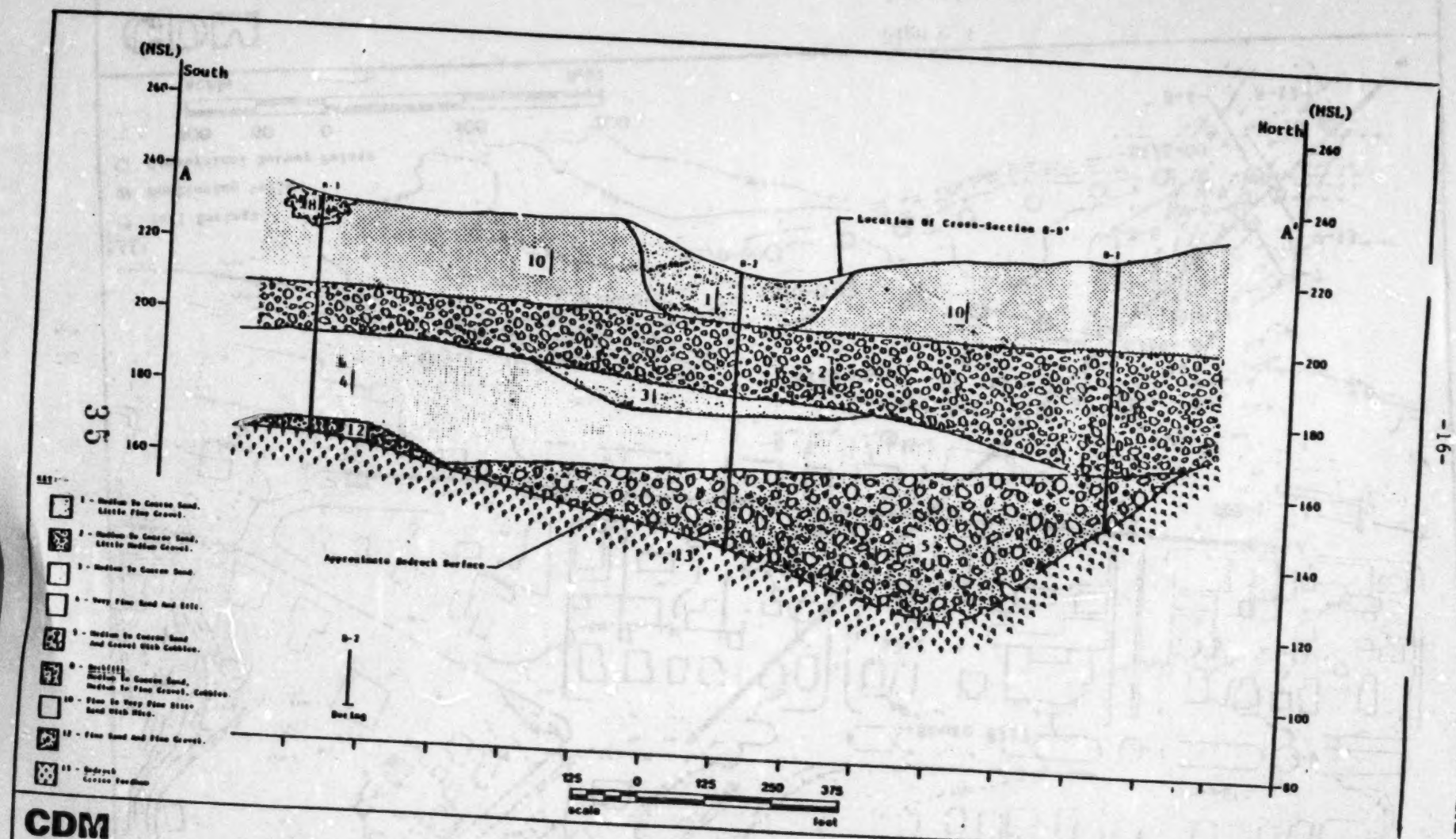

Figure 4
Stratigraphic Cross-Section A-A'
Municipal Well Site
New York

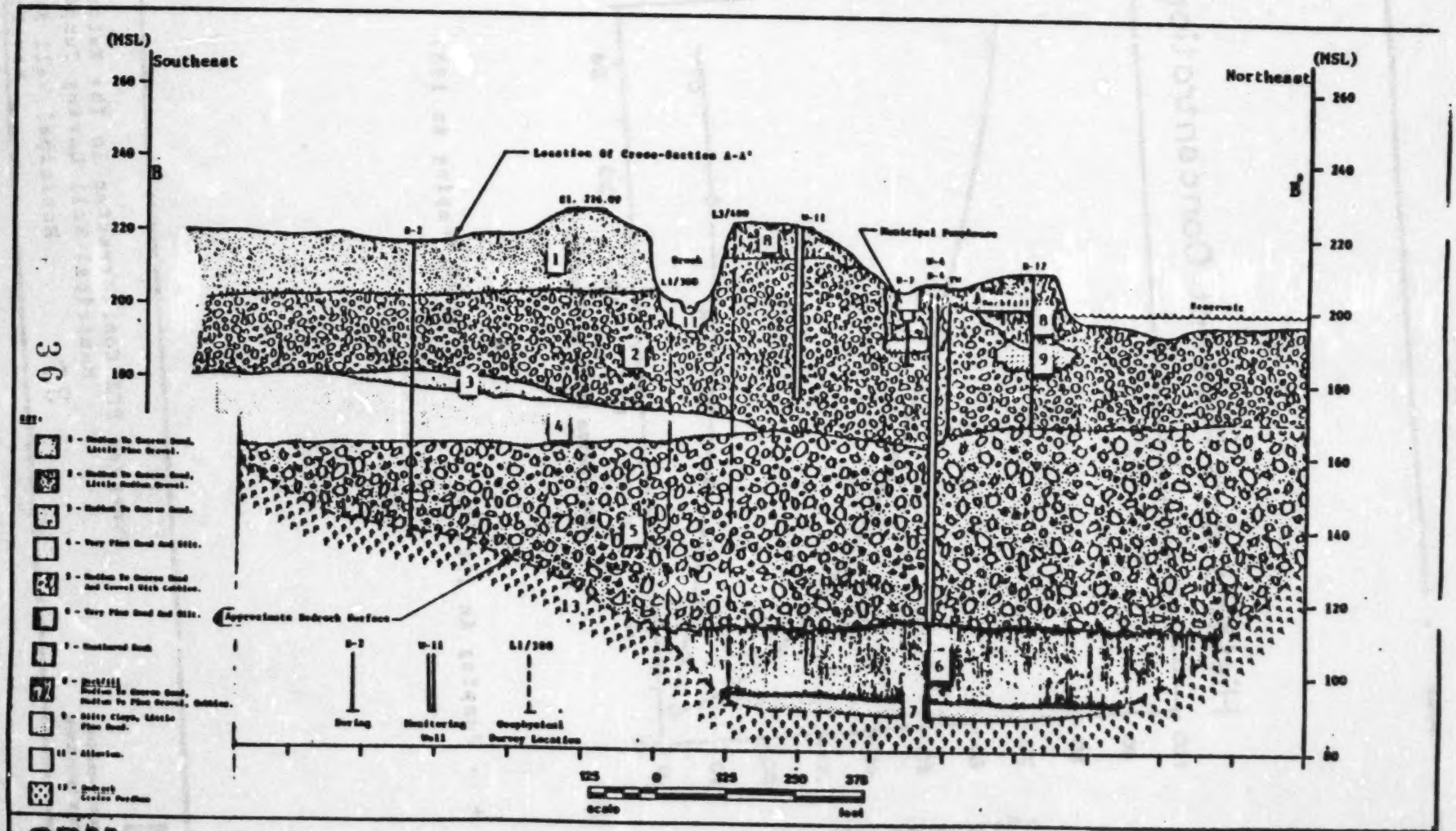

Figure 5
Stratigraphic Cross-Section B-B'
Municipal Well Site
New York

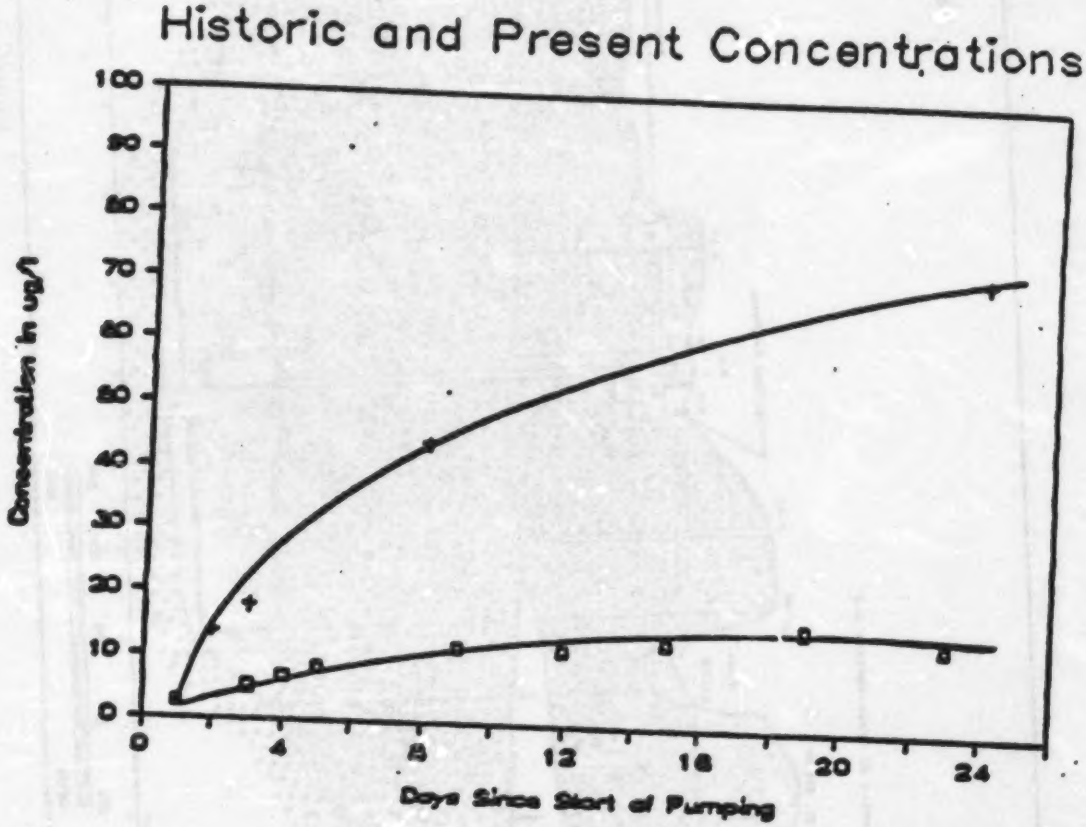

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Figure 6

Observed PCE Concentration In The Katonah Municipal Well During Pumping

Municipal Well Site

New York

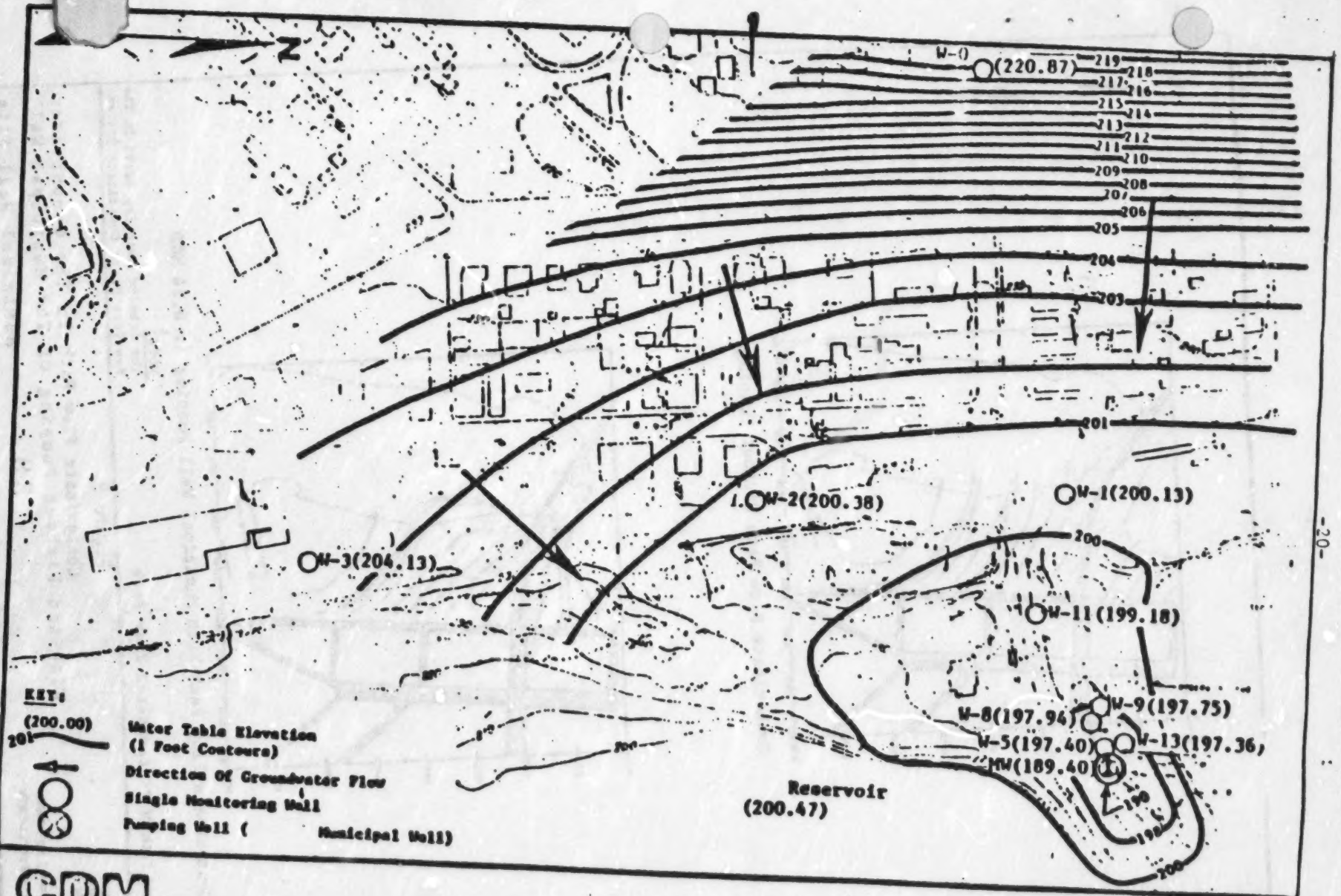

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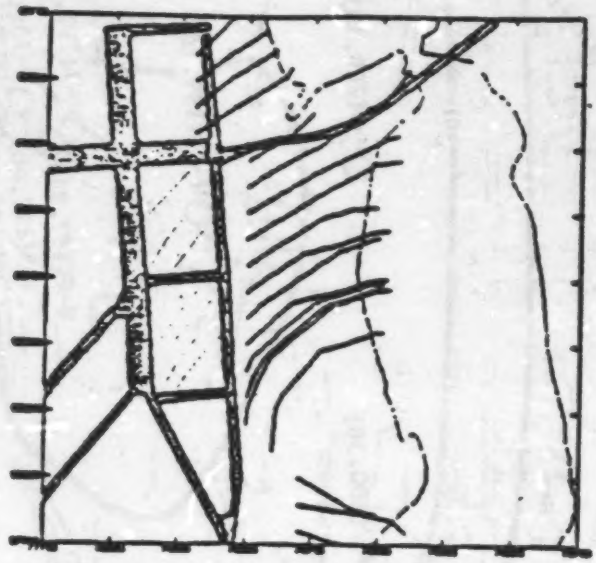
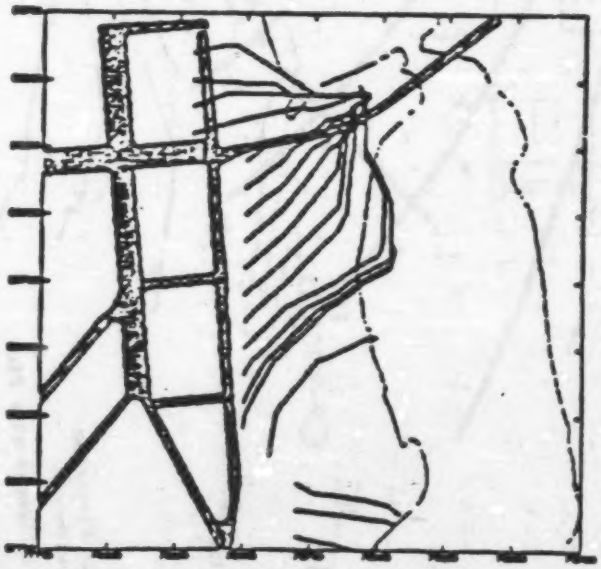
Figure 8

Water Table Surface Map/Pumping Conditions
March 23, 1987

Municipal Well Site
New York



Contaminate Flow Path Without Pumping



Contaminate Flow Path With Municipal Well Pumping At 0.24 MGD

KEY

Simulated Path Of Contaminated Flow Path

NOTE:
The Labeled Axes Are Based On The New York State Coordinate System

Figure 9

Contaminate Flow Path In The Groundwater With And Without Pumping Of The Municipal Well

Municipal Well Site
New York

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Table 1

Katonah Municipal Well Site

Cost* ($1,000)

Remedial Alternative	Capital	Annual O/M	Total PW**
1. No Action	0	0	0
2. Excavation and offsite soil disposal.	1,235	0	1,235
3. Excavation and offsite incineration of soils.	3,428	0	3,428
4. Containment of contaminated soil and ground water.	2,835	520	5,427
5. Replacement of lost water resource with no site remediation.	378	220	2,451
6. New production well facility and treatment with an air stripper, on-site.	1,365	296	4,155
7. Renovation of existing Katonah well and air stripper treatment on-site.	1,363	296	4,153

* Each of the above alternatives includes costs for required long term environmental monitoring.

** All total present worth values based on a 30 year project period.

TABLE 2

DESIGN CRITERIA FOR 370-GPM KATONAH WELL WATER
KATONAH, NEW YORK

I. BASIS OF DESIGN

Operation	24 hrs/day, 365 days/year
Flow Rate	370 gpm
Intended Use	Municipal Drinking Water

II. REMOVAL REQUIREMENTS

Contaminant	Influent	Effluent	% Removal
Tetrachloroethylene (PCE)	125 ug/L	0.8 ug/L	99.4

III. AIR STRIPPING TOWER

Tower Diameter	4 ft.
Height (total)	25 ft.
Packing Depth (type)	ft. (2-in Tripacks)
Hydraulic Loading	28 gpm/ft^2
Air:Water Vol. Ratio	40:1
Stripping Factor	20
Blower Size	2000 cfm: 5 hp
Pump Station No. 2	

IV. DISINFECTION

Contact time	30 min.
Wet well	1500 cu. ft.
Chlorine dosage, mg/L(lbs/day)	4 (18)
Pumping station: To distribution	2 pumps; 370 gpm @ 300 Ft. TDH 50 hp